



3/CS

Internal assessment: group 3 individual candidate coversheet

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Arrival date: 20 Apr / 20 Oct

Session:

May 2010

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International School of Prague

- Write legibly using black ink and retain a copy of this form.
- Complete this form in the working language of your school (English, French or Spanish).
- Attach one completed copy of this form to the work of each candidate represented in the sample.

Subject:

Psychology

Level:

HL

Candidate name:

Thu Trang Dao Pham

Candidate session number:

000889006

Title(s) and dates of work: (complete if appropriate)

- (1) Investigation of Acoustic Encoding in
- (2) short term memory
- (3)
- (4)

Teacher declaration

To the best of my knowledge, the material submitted is the authentic work of the candidate.

Signature of teacher:

Date:

May 2010

Candidate declaration: I confirm that this work is my own work and is the final version. I have acknowledged each use of the words or ideas of another person, whether written, oral or visual.

Candidate's signature:

Date:

May 25, 2010

Types of work undertaken (to be completed by teacher)

(for example, written assignment/essay/case study/fieldwork/portfolio/photography/video/computer)

Geography SL: note whether the one piece is *fieldwork* or a *research assignment* and to which theme it is linked.

Business and management SL: the issue or problem selected for the commentary must relate to the SL syllabus and refer directly to a single business organization (*Business and management guide*, March 2007, page 52).

Other relevant information (where appropriate)

Teacher support (where a candidate could not have completed the work without substantial support, please indicate)

Investigation of acoustic encoding in short term memory

by

Dao Pham Thu Trang

IB HL Psychology

Candidate number: 000889 – 006

Word Count: 1913

Instructor: John Crane

Date of submission: December 10, 2009

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Abstract

This experiment is based on Baddeley's(1966) study on memory; it investigates the effect of acoustic similarity or dissimilarity of words on one's ability to encode them into STM. Encoding information into memory is a processing of external information and the ability to recall. The research hypothesis states that a list of acoustically similar words is more difficult to encode than a list of acoustically dissimilar words. The independent variable is the words chosen for each condition; acoustically similar words rhyme, whereas acoustically dissimilar words do not. The dependent variable is the number of words recalled. The independent measures design was used for the experiment, 20 participants were divided into 2 groups of 10. Each group was given a different condition, after the words were read out loud, the students were supposed to write down as many words as they were able to recall. The sample of opportunity was used, students from another class participated. Using the Mann Whitney U Test to calculate the data, the results have rejected the research hypothesis indicating that there is no connection between the independent and dependent variable. This indicates that the acoustically similar words are as difficult to encode as acoustically dissimilar words. This contradicts the results of Baddeley's(1966) original study, where acoustically similar words were more difficult to memorize.

Introduction

Encoding, a process of receiving external information and coding it into one's memory, is studied in the cognitive perspective. It can be affected by various external factors which influence one's recalling process and can either enhance or impair memory. For example, when memorizing a list of words, it can be semantic or acoustic similarity or dissimilarity that can affect the ability to recall them. Acoustic encoding is defined as type of words in a list that sound similarly like *cat*, *hat*, and *fat*; and semantic encoding is defines as type of words in a list whose meanings are similar like *neat*, *clean*, and *tidy*.

Conrad(1964) argues that the only way that information can be coded into STM is through acoustic encoding. Moreover, he believes that visual encoding is transformed into acoustic, which is placed into the STM. Thus, regardless of whether the encoding is acoustic or semantic, it is placed into STM because of verbal repetition of the information to one self. Therefore, there is not visual storage in STM. He also investigated that during the acoustic encoding, words containing rhyming letters like 'B' and 'P' are more difficult to recall because of their acoustic similarity, than words containing letters that do not rhyme.¹

Conrad's(1964) theory is further expanded by A. D. Baddeley(1966), who not only investigated the acoustic similarity in words presented, but also the semantic similarity, comparing their effects on the STM. In his studies, he used four categories of words: acoustically similar like *cab* and *cap*, semantically similar like *big* and *long*, acoustically dissimilar like *day* and *bar*, and semantically dissimilar like *old* and *safe*. He found that words that were similar were significantly more difficult to recall than the words that were dissimilar. He also argues that encoding of acoustically similar words mainly impacts the STM rather than semantic encoding. When the meanings of the words were similar, there was a minor impact on STM, unlike the acoustically similar words, which were found to be hardest to recall.²

Despite the fact that Conrad(1964) and Baddeley(1966) argue that information is encoded into STM acoustically, Den Heyer & Barrett(1971) have studied and argued that visual encoding has a part in recalling through STM. They had their subjects to recall the location of letters, but also to identify them. Lists of letters were placed into different locations in a grid. The participants were supposed to recall the letters through either verbal processing or visual processing. They found that the recalling of the positions of the letters had a greater impact on the STM, but the identification of the sets of letters affected the STM by the verbal tasks more than the visual tasks, arguing that visual processing has a role in encoding information into STM.³

¹ Baddeley, A. D. (n.d.). *Short-term Memory for Word Sequences as a Function of Acoustic, Semantic and Formal Similarity*. In *The Quarterly Journal of Experimental Psychology* (Vol. 62). Psychology Press. (Reprinted from *The Quarterly Journal of Experimental Psychology*, 1966, 18, [4], pp. 362-365)

² Hill, G. (2001). *Memory*. In *A Level Psychology through Diagrams*. Oxford: Oxford University Press, p 105.

³ Paivio, A. (1990). *Episodic Memory*. In *Mental Representations: A Dual Coding Approach*. New York: Oxford University Press, p 156.

Aim: To investigate the effect of acoustic similarity and dissimilarity of words on an ISP student's ability to encode them into STM.

Null Hypothesis (Ho) – The same number of words will be memorized and recalled from a list of acoustically similar and acoustically dissimilar words.

Research Hypothesis (H1) – More words will be memorized when recalling a list of acoustically similar words than a list of acoustically dissimilar words.

Method

Design

The experimental design that was used is the independent measures. There were two groups, the first group was to memorize a list of acoustically similar words, and second group was to memorize a list of acoustically dissimilar words. Different students were assigned each group. This design was chosen to prevent order effects as participant's ability to learn and encode words could not be influenced by repeating it twice. Another factor that is prevented with this design is demand characteristics as they could not be able to guess the hypothesis and change their behavior to meet the hypothesis. The participants could not get bored, learn the words, and guess the aim of the study because each participated only once, which could have affected the memorization of words. The independent variable was the type of words chosen. There were two categories: acoustically similar words and acoustically dissimilar words. The dependent variable was the number of words memorized in each of the conditions. Time was standardized in the experiment. For the experiment to meet the ethical considerations, the participants gave informed consent, and consent from their parents was also received. They were debriefed after the experiment and the aim of the study was revealed.

Participants

The sample used was an opportunity sample; the participants were available from different classes, and thus, the easiest one to obtain because they were already there for us to use. Our sample was set of 20 participants, high school students, ranged in age from 15 to 16 years old, 12 girls and 8 boys. Our participants were of various nationalities and 5 students receive English language support. The advantage of using the opportunity sample is that it is quick and economical. However, the disadvantage of it is that it is not very representative of a general population or any targeted population because it is taken only from one class in one school.

Materials

Standardized instructions for both groups (see appendix i)

Informed letter of consent (see appendix ii)

Procedure

We divided a group of 20 participants into two separate groups of 10. One group received the acoustically similar words, while the other group received the acoustically dissimilar words (appendix iv). While one of the groups was completing the task, the other was asked to stand outside in silence. We read out loud the standardized instructions (appendix i), and gave each participant a letter of consent (appendix ii). One of the members of our group supervised the group that was waiting outside. The participants in the classroom wrote down the words they remembered. When both groups were through with the experiment they were debriefed about the actual aim of the study (appendix iii). After the data from the experiment was analyzed, we informed them of the results and what they meant.

Results

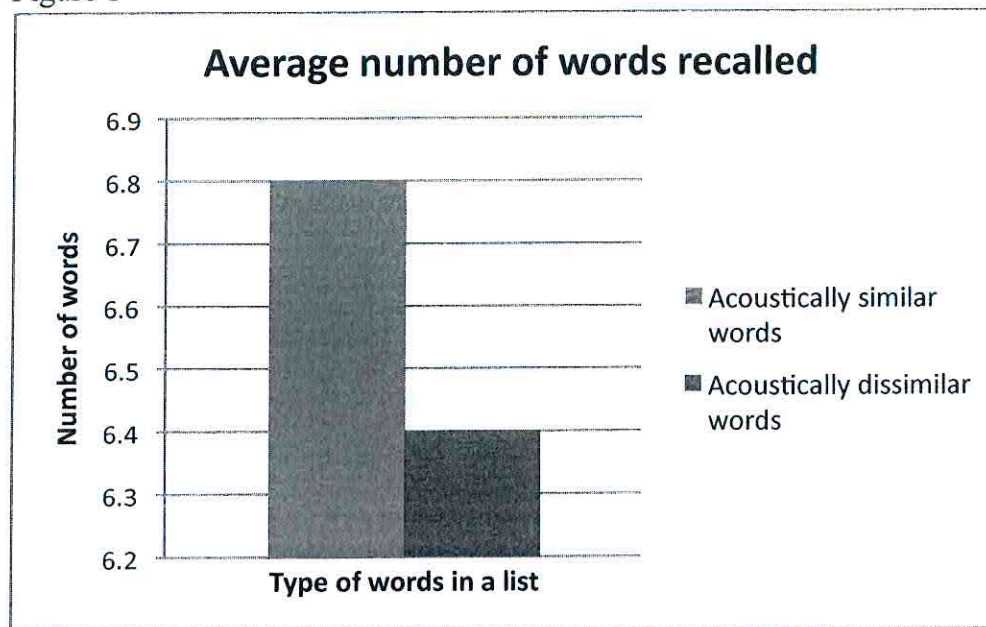
As seen in figure 1, the average number of words memorized for the group with acoustically similar words and group with acoustically dissimilar words are 6.8 and 6.4. Even though the average numbers are slightly different, the acoustically similar words are easier to memorize than the dissimilar words. To three significant figures, the standard deviation for the group with acoustically similar words is 1.23 and for the group with acoustically dissimilar words is 1.17. Therefore, the means are relatively representative, as the standard deviations are quite small. However, due to the minor difference between the means, the hypothesis cannot be evaluated. The raw data may be found in appendix v.

Table 1: The means and standard deviations of both groups

Types of words	Acoustically similar	Acoustically dissimilar
Average number of words	6.8	6.4
Standard deviation	1.23	1.17

The Mann Whitney U Test was used to determine the level of significance, because of the independent measures design in the experiment. The data obtained was interval, but it was converted into ordinal to use the Mann Whitney U Tests. This test type also describes the data most accurately because it is concentrated on results obtained when using small sample size (see appendix vi). The value of U_A was 39, which exceeds the critical value of 23 for $p \leq 0.05$, so the null hypothesis is retained.

Figure 1



Discussion

The results show that the same number of words will be memorized and recalled from a list of acoustically similar and acoustically dissimilar words. The findings are similar to the ones from Conrad's(1964) study, which indicates that information is encoded into STM through acoustic encoding. However, his findings also point out that words that include letters that rhyme like 'B' and 'P' are more difficult to recall. In our study, the effect of rhyming letters had no influence over the amount of words recalled because the participants did not recall any words that were not on the list. Furthermore, our findings do not correspond to the original study by Baddeley(1966). He found that acoustically similar words are more difficult to recall than acoustically dissimilar words. Nevertheless, in our study, words were encoded into STM, regardless of the condition. Furthermore, our results show that encoding is not influenced acoustically, which supports Den Heyer's & Barrett's(1971) theory that recalling through STM is mainly affected by visual encoding, not acoustic encoding. Therefore, Den Heyer's & Barrett's(1971) theory could explain why our results were not significant.

This experiment had several limitations regarding the methodology. A confounding variable in this experiment was language. Some words that were chosen for the list could have been hard to memorize for some participants as they might not have understood them. There were several students in our experiment who receive English language support. The fact that they might not have known a meaning of a word could prevent them from being able to recall it because they were not familiar with it. To modify it for further research, a list of 100 words would be made, from which students, who receive English language support, would circle the ones that they understand. The words most frequently circled would be used to create a list. Another limitation was the type of a sample used. Only an age group between 15 and 16 years old students was used from only one school, therefore the data is not representative of a

general population for students or the school. Different confounding variables that could have contaminated the experiment are, for example, the amount of sleep that each participant had the day before the experiment. Students who had more sleep could have memorized more words than students who did not. Another limitation is the volume and pronunciation of the words when stated in front of the class. In each class, the list of words was read by a different member of our group. The different pronunciations and volumes of voice by each of us could have affected the participant's ability to encode the words. This could have been improved by for example recording a voice saying the words, for which the volume would be adjusted and the voice would have the same impact in both groups. This also provides an opportunity to test the volume before the experiment to make sure that people can hear. Further research can be made by adding more independent variables, for example looking at the effect of semantically similar word the ability to memorize or look at particular gender if there is any difference in memorization between men and women.

A strength in our experiment was that the participants were asked to memorize as many words as possible, so we have told them how we wanted them to behave and we have also told them to put greatest effort into the process, thus the effect of demand characteristics was reduced. A different strength was that the procedure used was clear and exact because the standard instructions were used. Thus, it was easy for the participants to follow the directions. Also, this allowed to us to make a fair comparison between the two groups.

To conclude, our results were not statistically significant. The results show that the null hypothesis is retained, thus, the same number of words will be memorized and recalled from a list of acoustically similar and acoustically dissimilar words.

Works cited

- Baddeley, A. D. (n.d.). Short-term Memory for Word Sequences as a Function of Acoustic, Semantic and Formal Similarity . In *The Quarterly Journal of Experimental Psychology* (Vol. 62). Psychology Press. (Reprinted from *The Quarterly Journal of Experimental Psychology*, 1966, 18, [4], pp. 362-365)
- Hill, G. (2001). Memory. In *A Level Psychology through Diagrams*. Oxford: Oxford University Press.
- Paivio, A. (1990). Episodic Memory. In *Mental Representations: A Dual Coding Approach*. New York: Oxford University Press.

Appendix i: Standardized Instructions

You are about to participate in an experiment that is concerned with the ability to remember a list of words read out loud to you by one of our members. The whole experiment is going to take about 10 minutes, which are divided into two sections. Before we start the experiment, you will be asked to remove all items from your desks. After reading the list of words, you will have to wait 20 seconds until you can start writing the words on the sheet of paper in front of you. You will be told when you can start writing. Then, you will be given a minute to write down as many words as you can recall. After the minute is up, you will be alerted by our group members, and you will have to put your pens down.

Then, we will collect the pieces of paper. Once we have your data, you will be asked to leave and wait outside in silence. (Referred to the first group that has participated in the experiment)

Appendix ii: Informed Consent Letter

Letter of Consent:

- I, _____, am a willing participant of this study.
- I have been informed of the experiment's aim.
- I have the right to withdraw my participation during any part of the study. I am also aware that my results will remain anonymous.
- I am aware that my participation in this study will not cause any permanent changes.
- I will be debriefed after the experiment has been conducted.

Participant Signature: _____

Date: _____

*I am informed of my child's participation in this study, and I give my consent.

Parental Signature: _____

Appendix iii: Debriefing Notes

Dear participants,

We would like to thank you for participating in our study. This experiment was based on the theory that words which are acoustically similar are more difficult to remember than words that are acoustically dissimilar. Acoustically similar words sound alike, or rhyme, while acoustically dissimilar words do not, hence they can be encoded in the short term memory – which lasts up to 12 seconds.

You were divided into two groups. While one group was waiting outside, the other listened to the acoustically similar words. The same thing happened with the group that followed, only you listened to words that were acoustically dissimilar. We asked you about your level of English specifically because we needed to know how well acquainted with the language you are. This is important because the reason you might not have been able to recall some words is because you couldn't spell them, or have never heard them before.

We then looked at the results from both groups. It is necessary to say that most people remembered up to 7 ± 2 words, no matter which group they were placed into. However, when we compiled the results, we did not find a clear connection between our independent variable, which was the acoustically similar/acoustically dissimilar items, and our dependent variable, which was the average amount of words remembered in each group. Our data stated that acoustically similar words are just as difficult to remember as acoustically dissimilar words. However, these results are not consistent with the study that our experiment was based upon. In the original study by Baddley, acoustically similar words were harder to memorize in the short-term memory. We would also like to remind you that your data will remain confidential.

Once again, we thank you for participating in our study.

Appendix iv: List of words for acoustically similar and dissimilar condition

Acoustically similar list of words

Mad
Man
Mat
Cap
Cad
Can
Cat
Fat
Rat
Rap
Lap
Nap

Acoustically dissimilar list of words

Cow
Day
Bar
Few
Hot
Pen
Sup
Pit
Man
Lip
Kit
Bit

Appendix v: Raw data

Group with acoustically similar words	Group with acoustically dissimilar words
7	7
8	8
6	5
7	5
8	7
4	8
7	6
7	6
8	7
6	5

Appendix vi: Mann Whitney U Calculations

Sample A= Acoustically similar words

Sample B= Dissimilar words

count	Ranks for		Raw Data for	
	Sample A	Sample B	Sample A	Sample B
1	12	12	7	7
2	18	18	8	8
3	6.5	3	6	5
4	12	3	7	5
5	18	12	8	7
6	1	18	4	8
7	12	6.5	7	6
8	12	6.5	7	6
9	18	12	8	7
10	6.5	3	6	5

$$U_A = 39 \quad z = 0.79 \quad P_{(1)} = 0.2148 \quad P_{(2)} = 0.4295$$

Critical Values of U for $n_a=10$; $n_b=10$

	Level of Significance for a		
	Directional Test		
	.05	.025	.01
	Non-Directional Test		
	--	.05	.02
lower limit	27	23	19
upper limit	73	77	81